4. Impotency from any cause does not seem materially benefited from local treatment.

5. Application of this method to diagnosed or undiagnosed malignancy may lead to more rapid growth and to an increase in the degree of malignancy.

6. Treatment of the posterior urethra and bladder, with the glass electrodes now furnished, is for obvious reasons fraught with danger.

7. Soft infiltrations, keloid-like formations, fibrosis and burns may follow overexposure.

CONCLUSIONS

1. Cold quartz ultraviolet light therapy in urology is not a "cure-all"; is not a panacea or an answer to the urologist's prayers, but is a useful, valuable adjunct to our present methods of treatment.

2. Only by intelligent application and observation of a large number of cases by many workers can the true value of this method be ascertained.

3. The author of this paper has now in contemplation apparatus that will enable us to safely treat the interior of the male bladder; also apparatus by which the ureter, kidney pelvis and calyces may be safely treated.

4. Preliminary ultraviolet irradiation of medicinal substances (inorganic preferably, such as mineral oil), and then injection of this substance into the inflamed bladder, offers a possibility of therapeutic results.

527 West Seventh Street.

REFERENCES

1. Coblentz, W. W.: Sources of Ultraviolet Radiation and Their Physical Characteristics, J. A. M. A., 92:1834-37 (June 1), 1929.

2. Coblentz, W. W., Long, M. B., and Kahler, H.: Decrease in Ultraviolet and Total Radiation with Usage of Quartz Mercury Vapor Lamps. Scientific papers of Bureau of Standards Bulletin, 15:6, 1928.

3. Anderson, W. T., Macht, D. I., and Bell, F. K.: General Action of Irradiation of Mucous Membrane with Ultraviolet Light, Abstract J. A. M. A., 84:1160 (April 11), 1925; The Penetration of Ultraviolet Light into Animal Tissues, J. A. M. A., 90:161-165 (Jan. 21), 1928.

4. Bayne, Jones and Linden, J. S.: Bactericidal Action of Ultraviolet Light, Bull. Johns Hopkins Hosp., 34:11-16 (Jan.), 1923. Burge, W. E.: Germicidal Action of Ultraviolet Radiation and Its Correlation with Selective Absorption, Arch. Radiol, and Electroth., 23:85-90, 1919.

5. Goodman, H.: Action of Ultraviolet Irradiation on the Bactericidal Property of the Blood, J. A. M. A., 90:280-284 (Jan. 28), 1928.

6. Kosan, Friedland: Bactericidal Effect of Ultraviolet Light on the Tubercle Bacilli, Brit. M. J., 2:160, 161 (July 30), 1927; Action of Ultraviolet Light on Tubercle Bacilli, Am. Rev. Tuberc., 13:470-474 (May) 1926, and Am. Rev. Tuberc. 10:166-169, 1924.

7. Pohle, E. A., and Hafford, W. S.: Standardization of Ultraviolet Rays, J. A. M. A., 86:818-820 (March 20), 1926.

8. Loundsberry, Ray C.: Histologic Changes in Organs Following Ultraviolet Therapy, Abstract J. A. M. A., 82:1487 (May 23), 1924.

9. Andrews, George C.: Diseases of the Skin. Saunders, 1931.

DIVERTICULOSIS OF THE DUODENUM*

By KENNETH S. DAVIS, M. D.
Los Angeles

DISCUSSION *by John D. Lawson, M. D., Woodland; Milton J. Geyman, M. D., Santa Barbara; Carl H. Parker, M. D., Pasadena.*

DIVERTICULOSIS of the duodenum is not an uncommon finding in the routine gastro-intestinal examination, but seldom gives positive clinical manifestations of its presence. A study of the frequency of this condition shows a considerable variation in reports from different sources.

Based on the roentgenologic examination, Case [3] reports eighty-five cases of diverticulosis in 6,847 patients; Andrews,[1] 26 in 2,200 patients; Spriggs,[15] 10 in 1,000 examinations; Penhallow,[14] 11 in 2,200; Larimore and Graham,[8] 19 in 3,446, and Heacock,[5] 14 in 1,540 examinations. In the roentgen ray laboratory at St. Vincent's Hospital we have had twenty-four cases of duodenal diverticulosis in 2,503 consecutive gastro-intestinal studies. This gives a total of 189 cases of diverticulosis in 19,736 examinations, or approximately one per cent.

The statistics, quoted from autopsy records, give a total of 83 diverticula in 2,617 examinations, or a percentage of 3.2. This difference in the incidence would indicate that the roentgenologist is overlooking about two out of every three cases of diverticulosis.

HISTORICAL

Chomel, in 1710, is credited with the first description of a diverticulum from the duodenum, although this may have been a dilated ampulla of Vater, as it contained twenty-two gall-stones. Morgagni in 1761, Rahn in 1796, and Fleishman in 1815, described cases found postmortem. Up to 1908 less than one hundred cases of duodenal diverticula had been recorded.

In 1913 J. T. Case first demonstrated cases of duodenal diverticulosis diagnosed during life by means of the opaque meal. In 1915 Forsel and Keys diagnosed a case of duodenal diverticulum by the x-rays and confirmed their findings at operation.

CLASSIFICATION

Odgers [12] divides diverticula of the duodenum into:

1. *Primary diverticula,* in which there is no obvious cause for the appearance of the diverticulum;

2. *Secondary or acquired diverticula,* usually caused by duodenal ulcer or by adhesions from the gall-bladder or neighboring viscera. These diverticula are almost always found in the first portion of the duodenum, and in the autopsy room

---

* From the x-ray laboratory of St. Vincent's Hospital, Los Angeles.

* Read before the Radiology Section of the California Medical Association at the sixty-first annual session at Pasadena, May 2-5, 1932.

are seen to have a complete muscular coat. Rarely a secondary pulsion diverticulum will be found.

3. *Dilated ampulla of Vater.*

PRIMARY DIVERTICULA

Diverticula in this group are characterized: By their location, being found only in the second, third, and fourth portions of the duodenum; by the fact that they always grow out from the concave border of the bowel; they are usually in relation to the pancreas; typically they are flask-shaped protrusions of the mucous membrane through the muscular coats of the bowel wall and communicate with the lumen of the bowel through a constricted neck; they are found best developed in persons over fifty years of age; more than one diverticulum may be present.

Primary diverticula vary considerably in size, from one-half to five centimeters in depth; they also vary in shape, but the majority have an expanded fundus narrowing to a neck which opens by an orifice of varying size into the bowel. The sacs are usually collapsed and empty when found in the autopsy room, but may be filled with chyme or food. The walls of the pouch are made up of mucous membrane, muscularis mucosa, and a thin submucosa layer. The muscle stops abruptly at the neck of the sac.

ETIOLOGY

Herbst [6] quotes ten theories to explain the production of primary diverticula: chief among these is the congenital theory, in which the diverticula are thought to be abortive attempts to form supernumerary pancreases, or that the pancreatic anlages cause local defects in the musculature, with pouching occurring with age and increase in duodenal pressure. Nagel [11] states that "whatever the time or cause of their appearance, these diverticula are formed on a developmental basis, as they occur at actual or potential weak spots in the bowel wall." Odgers [12] states: "In any case the pouches are probably due to congenital *loci resistentiæ minoris*. At certain periods the mucous membrane has pierced possibly only partially the muscular wall, and at these spots normal wear and tear will produce pulsion diverticula." Odgers was able to demonstrate potential diverticula in the embryo, this consisting of marked activity of the duodenal epithelium, which proliferates so quickly that the lumen of the bowel is occupied by a series of vacuoles, some of which produce outward bulgings into the surrounding mesenchyme.

Duodenal ulcer plays an important part in the etiology of secondary diverticula. Robertson and Hargis [6] measured the distance between the pylorus and the ampulla of Vater in a large series of cases. They found that the distance was shortened by several centimeters in cases of duodenal ulcer with scars. Since most duodenal ulcers are located on the anterosuperior border of the duodenum, most of the shortening takes place along this border, leaving the inferior border redundant and a favorable location for the formation of a secondary diverticulum.

PATHOLOGY

In the majority of cases primary diverticula are found as empty sacs lying in a bed of areolar tissue in relation to the head of the pancreas. They have a comparative immunity from inflammation due to the sterility of the duodenal contents. Diverticulitis has been reported in several instances with or without perforation. Peridiverticulitis has been noted by Case and Maclean,[10] this consisting of adhesions. Gall-stones: several cases of gall-stones in the common duct, associated with a diverticulum near the ampulla of Vater, are on record. One of the cases in my series is of this type.

SYMPTOMS

The great majority of diverticula of the duodenum give rise to no symptoms and are discovered only in the gastro-intestinal examination or in the autopsy room. Even with a definite diverticulitis present there are no specific signs or symptoms which are pathognomonic of these pouches. In a case reported by Hunt and Herbst [7] the symptoms and x-ray findings were those of pyloric obstruction. At operation a tumor, involving the entire circumference of the pylorus, was found which proved to be a dissecting diverticulum communicating with the gall-bladder, and was packed with gall-stones. In the majority of the cases of duodenal diverticulitis the symptoms simulate duodenal ulcer or gall-bladder disease. In the "ulcer" type there is epigastric pain and tenderness, vomiting, sour stomach, heart burn, and flatulence. The "gall-bladder" type are usually found in diverticula near the ampulla of Vater. Symptoms in this type of case are those of jaundice and biliary colic.

DIAGNOSIS

No case has yet been accurately diagnosed on clinical evidence; the usual diagnosis is duodenal ulcer or gall-bladder disease. The only method of diagnosis is the gastro-intestinal examination. This examination should determine the size and shape of the diverticulum; the situation; the dimensions of its orifice; the mobility of the diverticulum; the length of time that barium is retained; and the relation of the diverticulum to the point of tenderness on palpation. The characteristic x-ray finding is a localized collection of barium, extraluminal, with a smooth, circumscribed border. Usually one can demonstrate the connection between the diverticulum and the lumen of the bowel, especially when the diverticulum is carefully palpated. Occasionally the diagnosis is based on the retention of barium in the diverticulum after the stomach and duodenum are empty. Twelve of my cases had a six-hour residue in the diverticulum.

DIFFERENTIAL DIAGNOSIS

Any shadow (gall-stones, urinary calculus, calcified mesenteric lymph nodes, etc.), lying in the close vicinity of the duodenum may be mistaken for a diverticulum. However, if a "scout" film of

Fig. 1

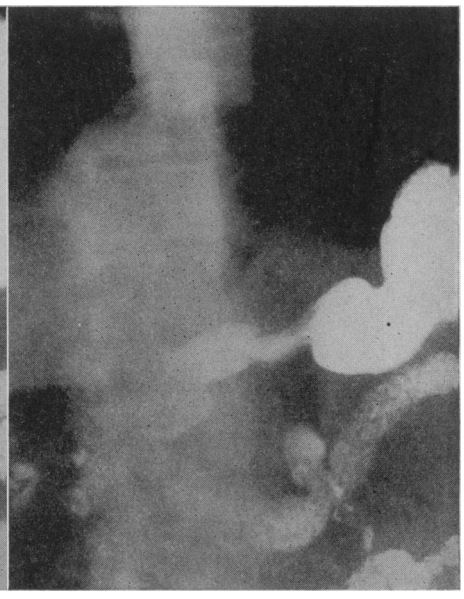

Fig. 2

Fig. 1 (Case 1).—Diverticula of the duodenum, associated with a gall-stone in the common duct. Removal of the gall-stone and drainage of the gall-bladder gave complete relief from symptoms. The diverticula were not removed.

Fig. 2 (Case 1).—A roentgenogram made five years later. Both of the diverticula show a distinct increase in size, despite the fact that patient remains free from symptoms.

the abdomen is made prior to the administration of the barium these should easily be ruled out. Barium retained in a haustra of the transverse colon may simulate a diverticulum of the duodenum in appearance. Careful palpation should differentiate between the two.

Pseudodiverticula due to a bulge, proximal or distal to the contraction of a duodenal ulcer, are extremely difficult to differentiate from actual diverticula secondary to ulcer. However, primary diverticula, which occur only in the second, third, and fourth portions of the duodenum, are not likely to be misdiagnosed in this respect. In one of my patients a large diverticulum of the fourth portion of the duodenum was mistaken for a perforated malignant gastric ulcer with an accessory pocket, as it contained a fluid level with a gas bubble at the top.

In another case a diagnosis of traction diverticula was made, but at the autopsy this was found to be the fibrous remnants of a gall-bladder which had perforated into the duodenum. Dilated ampulla of Vater cannot be differentiated from true primary diverticula. The three characteristics of a primary diverticulum are: its mobility on palpation; its lack of pain on palpation; and the tendency for six-hour retention of the barium in the diverticulum.

REPORT OF CASES

Case 1.—Patient, a male, sixty-six years of age, was admitted to the hospital February 2, 1926, complaining of anorexia, jaundice, and weight loss. About three months prior to admission he began having an indefinite epigastric distress not relieved by food or soda, but with temporary relief on catharsis.

Anorexia was pronounced, due partially to the flatulence brought on by eating. During this period he had lost approximately forty pounds in weight. Six weeks before admission he had a rather severe icterus which, however, was considerably improved when he entered the hospital.

Previous illnesses had no apparent bearing on present symptoms. He could never remember having had any gastro-intestinal troubles prior to the onset of present illness.

Roentgenographic Findings. Repeated gall-bladder dye studies failed to show any opaque substance in the gall-bladder although the patient had no diarrhea or vomiting, and the dye substance had been absorbed from the gastro-intestinal tract, none being seen in the scout film of the abdomen. The gastro-intestinal examination showed both the stomach and duodenal cap normal in appearance. In the second portion of the duodenum there was noted a triangular-shaped accessory pocket of barium in approximately the region of the ampulla of Vater. There was a six-hour retention of barium in this pouch.

There was also another pouch on the superior surface of the third portion of the duodenum, the latter having the characteristic appearance of a diverticulum (see Fig. 1). There was a normal motility of the barium except for the barium residue in the diverticulum. The barium enema failed to show any demonstrable lesion. No diverticula were present in the colon.

Operative Findings.—The gall-bladder was tense and distended with bile. No gall-stones were found. The common bile-duct was enormously enlarged and a gall-stone 1.5 by 2 centimeters in diameter was found lying in the lower end near the ampulla of Vater. The gall-stone was removed and a catheter passed into the hepatic duct and sutured. The gall-bladder was opened and drained. Neither of the diverticula was removed.

Following a rather stormy convalescence patient made a complete recovery, and up to the present time has had no recurrence of his symptoms. Despite this a roentgenographic study on December 5, 1931 (five years later), still showed both diverticula present (see Fig. 2). Both of the diverticula were distinctly larger than in 1926. Apparently the diverticula had no relationship to the patient's symptoms despite the gall-stone in a dilated common duct.

* * *

Case 2.—The patient, a female, age seventy-two, entered the hospital December 5, 1929, complaining of weakness, tarry stools, and pain in the left lumbar region. Five weeks before admission to the hospital she had a sudden gastric hemorrhage following which the stools had been constantly dark in color and tarry in appearance. During this time her only complaint was a slight burning pain in the epigastrium, relieved by food and soda. Her appetite was always good and there had been no nausea or vomiting. For ten days prior to her admission to the hospital she was quite weak owing to the constant loss of blood. There was a moderate weight loss.

Past History.—Usual childhood diseases; no serious illness since. For several years she had noticed a slight dyspnea on marked exertion, not enough, however, to prevent her usual daily activities. She did not recall having had any gastro-intestinal disturbance

prior to onset of present symptoms.

Roentgenographic Findings. The preliminary scout film of the abdomen showed a large circular-shaped gas pocket in the epigastrium. After the patient had swallowed the barium this was found to lie medially to the lesser curvature of the stomach (see Fig. 3). The pocket was about three inches in diameter, spherical in shape, and there was a definite fluid level in its lower third. After the barium had been in the stomach for a few minutes it filled the lower third of the pocket. Gas was present in the pocket throughout the entire examination; change in position of the patient failed to change the fluid level. The contour of the stomach was smooth and symmetrical with no demonstrable filling defects, niches, etc., nor was there any demonstrable connection of the stomach to the pocket so far as could be determined. However, on direct anteroposterior palpation there was found a large carcinomatous ulcer on the posterior wall, giving the typical meniscus sign as described by Carman. This finding suggested that the pocket was due to a perforation of the ulcer with the formation of an accessory pocket. Exploratory operation was advised, but refused by the patient, who died February 3, 1930.

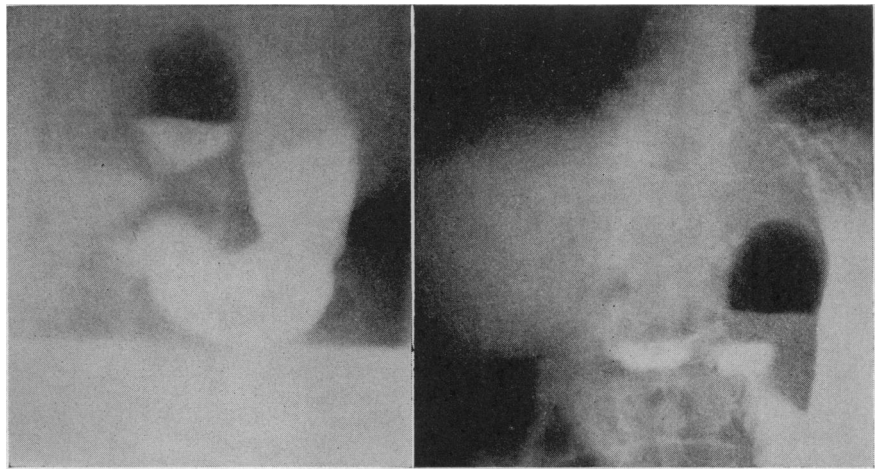

Fig. 3 (Case 2).—Diverticulum of the fourth part of the duodenum, associated with a carcinomatous ulcer of the posterior wall of the stomach. The diverticulum had all of the roentgenographic characteristics of an accessory pocket due to perforated ulcer. The fluid level remained unchanged with change in posture of the patient.

Autopsy Report.—The thorax is negative except for a moderate enlargement of the heart. "The stomach contains about 200 cubic centimeters of thick grayish fluid. About 3 centimeters from the pyloric ring on the posterior wall there is a large circular-shaped malignant ulcer 8 centimeters in diameter and three centimeters deep, with indurated edges from 1 to 1½ centimeters thick. The duodenum is dilated and contains a quantity of gray mucus. There is a large diverticulum in the fourth portion of the duodenum measuring about three inches in diameter. The diverticulum is adherent to the undersurface of the malignant ulcer, but there is no direct communication between the stomach and the pouch. The diverticulum communicates with the duodenum through an opening about 2 centimeters in diameter. Its walls are smooth and thin, apparently containing normal mucosa. There are no anomalies seen in the pancreas."

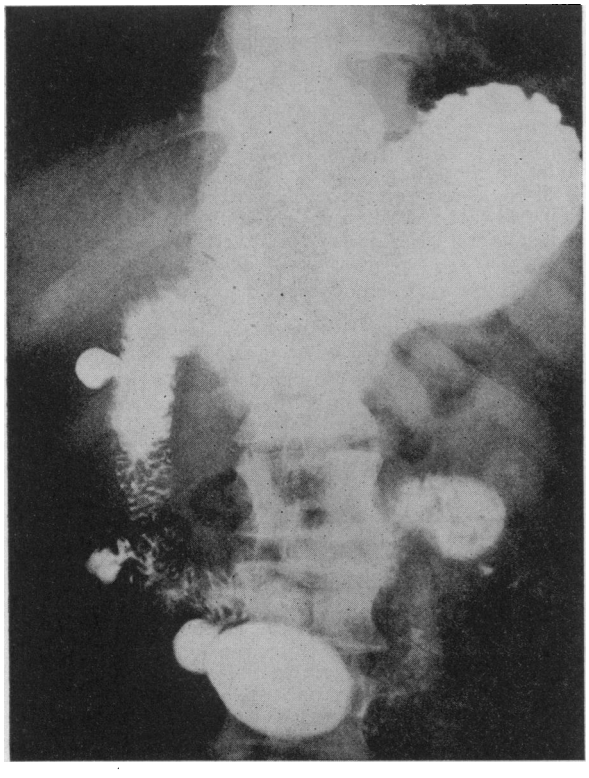

Fig. 4.—Multiple diverticula in the second, third, and fourth portions of the duodenum. The large diverticulum measured 4.5 centimeters in depth and 6 centimeters in diameter. There was a forty-six-day stasis of the barium in this diverticulum. Note the unusually low position of the third and fourth portions of the duodenum. The weight of the diverticulum may partially explain this abnormal position.

Anatomical Diagnosis.—"Carcinoma of stomach, ulcerated; diverticulum of duodenum; generalized arteriosclerosis; obesity; and hypertrophy of the heart."

COMMENT

In this case we find a large diverticulum of the fourth portion of the duodenum, with roentgenographic findings suggestive of an accessory pocket due to perforation. As a possible source of perforation there is a malignant ulcer on the posterior wall of the stomach. It is difficult to see how there could be a fluid level when the opening of the pocket into the duodenum was approximately two centimeters in diameter.

Lund [9] has reported a case of diverticulum of the fourth portion of the duodenum with roentgenographic findings very similar to this case. However, in his case there was no coexisting pathology in the stomach and the diverticulum communicated with the duodenum through a long narrow stem. In his case, too, the diverticulum had caused symptoms suggesting gall-bladder disease, while in my case no symptoms were noted prior to the onset of the cancer.

St. Vincent's Hospital.

REFERENCES

1. Andrews, E. W.: Duodenal Diverticula, J. A. M. A., 77:1309-1311, 1921.

2. Case, James T.: Roentgen Observations on the Duodenum, with Special Reference to Lesions Beyond the First Portion, Am. J. Roentgenol., 3:314, 1916.

3. Case, James T.: Diverticula of the Small Intestine Other Than Meckel's Diverticulum, J. A. M. A., 75:1463-1470, 1920.

4. Cole, L. G., and Roberts, D.: Diverticula of the Duodenum, Surg., Gynec., and Obst., 31:376-381, 1920.

5. Heacock, C. H.: Diverticula of the Duodenum, South. M. J., 22:348-351, 1929.

6. Herbst, William P.: Diverticula of the Duodenum, Minnesota Med., 10:364-368, 1927.

7. Hunt, Verne C., and Herbst, William P.: False Diverticulum of the Duodenum Containing Gall-Stones, with Cholecyst Diverticular Fistula, Surg. Clin. of North America, 5:807, 1925.

8. Larimore, J. W., and Graham, E. A.: Diverticula and Duplicature of the Duodenum with Reference to the Importance of Cholecystitis in the Production of Symptoms, Surg., Gynec., and Obst., 45:257-265, 1927.

9. Lund, F. B.: A Case of Diverticulitis of the Fourth Part of the Duodenum, New England J. Med., 198:986-988, 1928.

10. Maclean, Neil J.: Duodenal Diverticulitis, Ann. Surg., 85:73-79, 1927.

11. Nagel, G. W.: Unusual Conditions in the Duodenum and Their Significance, Arch. Surg., 11:529-549, 1925.

12. Odgers, P. N. B.: Duodenal Diverticulosis, Brit. J. Surg., 17:592-617, 1930.

13. Pendegrass, Robert C.: Duodenal Diverticula, Am. J. Surg., 5:491-497, 1928.

14. Penhallow, D. P.: A Case of Duodenal Diverticulum, J. A. M. A., 80:1372-1374, 1923.

15. Spriggs, E. I.: Duodenal Diverticula, Brit. J. Surg., 8:18-26, 1920.

DISCUSSION

JOHN D. LAWSON, M. D., Woodland Clinic, Woodland).—Diverticulosis of the gastro-intestinal tract is a subject which has found its way into the literature rather consistently. Previous to the advent of the radiopaque meal, it was by reason of anatomical study, but since 1913 the subject has been primarily of radiologic interest.

Eliminating the colon from consideration, the duodenum is most frequently the site of diverticulosis, referring, of course, to the congenital type of diverticulum. It would appear that the frequency of this lesion is much more common than is generally considered.

The roentgenologist must have in mind the possibility of this lesion in the examination of every patient, and while the second, third, and fourth portions of the duodenum are extremely infrequently involved by any pathologic condition amenable to roentgen-ray diagnosis, yet the observation of these structures must be carefully followed out in order that this type of lesion be not overlooked.

Examination must be made in both the prone and erect positions, and sufficient manipulation and rotation must be done to insure a complete visualization of the entire duodenum. It is frequently stated that diverticuli of the first portion of the duodenum do not occur, but in this I cannot concur, as diverticuli at this site have been noted in several cases which have come under my observation.

I believe the roentgenologist should most certainly stand his ground when a diagnosis of duodenal diverticulosis has been made and the surgeon fails to demonstrate the lesion at operation. There is very little possibility of the trained roentgenologist being in error in this opinion, and the detection and demonstration of a thin-walled sac in the retroperitoneal structures is a matter of considerable skill and good fortune on the part of the surgeon.

❦

MILTON J. GEYMAN, M. D. (1520 Chapala Street, Santa Barbara).—Doctor Davis has given us an excellent discussion of duodenal diverticula and his cases are very interesting. While there is no specific group of symptoms in duodenal diverticulitis, we believe many of them are symptom-producing and that their recognition is important. Our impression with regard to their occurrence is that they are more often multiple than single. We agree that the majority occur on the concave side and are almost always of the pulsion type. Rarely they may be seen projecting upward from the superior aspect of the last portion of the duodenum. We have also seen one case in which a long bottle-shaped diverticulum projected downward from the convex aspect of the duodenal second portion. Such unusual duodenal diverticula are usually of the traction type. Any barium-filled structure projecting from the convexity of the duodenal loop of course requires an exclusion of the possibility of cholecystoduodenal fistula.

In considering the differential diagnosis of duodenal diverticula Doctor Davis mentioned dilatation of the ampulla of Vater. Berg has published a case in which a roentgen diagnosis of peptic ulcer in the second portion of the duodenum was confirmed at operation. The roentgen appearance of this lesion closely simulated that which obtains with barium deposition in a dilated ampulla of Vater. We have never seen extrabulbar duodenal ulcer nor noted a report of such a lesion in the American literature. A consideration of peptic ulcer in the differential diagnosis of diverticulum is, therefore, probably of no great importance in this country.

❦

CARL H. PARKER, M. D. (65 North Madison Avenue, Pasadena).—Only two of our cases of diverticula of the duodenum have been operated upon where the diverticula were the point of attack. One case was lost track of immediately after the recovery from the operative procedure and thus is of no importance in drawing deductions.

The second case presented symptoms of discomfort in the upper abdomen, associated with vomiting. The clinical findings were suggestive of gall-bladder disease. The roentgenographic study revealed no evidence of pathology in the gall-bladder or stomach, but did show four diverticula of the duodenum and one of the jejunum. This patient was operated upon by Dr. Leroy Sherry of Pasadena, who succeeded in finding and removing three of the four duodenal diverticula. None of them presented any evidences of inflammation. The patient has been entirely relieved of her symptoms, so that it is reasonable to conclude that the diverticula were responsible for the disturbance. There was no other operative procedure.

❦

DOCTOR DAVIS (Closing).—Since this paper has been in press the author has observed several cases of diverticulosis of the duodenum, one of which is especially worthy of presentation.

This patient, a physician, sixty-seven years of age, was referred for a gastro-intestinal examination on November 3, 1932, complaining of hyperacidity and indefinite epigastric distress. The hyperacidity had persisted for thirty years, so that a clinical diagnosis of duodenal ulcer had been frequently made previous to 1919. His epigastric distress consisted chiefly of moderate food retention in the stomach and a feeling of increased abdominal tension, especially in the epigastrium. In 1927 he had had symptoms suggesting an acute intestinal obstruction which, however, disappeared after taking paregoric. For the past ten years he has found it necessary to reduce the size of his meals, also to eliminate leafy and stringy vegetables. He has frequently induced vomiting to relieve the feeling of increased abdominal tension.

The gastro-intestinal examination revealed the presence of four diverticula in the upper small bowel; three of them were in the duodenum, the fourth was either in the fourth portion of the duodenum or in the first portion of the jejunum (see Fig. 4).

All four of these diverticula were on the *convex* side of the bowel, a location exactly the reverse of cases described in the literature. Certainly they were not in relationship with the head of the pancreas. The diverticulum in the first portion of the duodenum had a twenty-four-hour residue. The most distal diverticulum was 4.5 centimeters in depth and 6 centimeters in width, one of the largest on record. To date (December 19, 1932), there is still a moderate barium residue present in this diverticulum; a forty-six-day stasis. This diverticulum was tender on palpation, but not fixed.

Apparently this case is one in which the diverticulosis is the actual cause of the patient's symptoms.

FRACTURES—THEIR TREATMENT*

THE CLINICAL APPLICATION OF CERTAIN FUNDAMENTAL PRINCIPLES

By FRANK J. BRESLIN, M. D.
Los Angeles

DISCUSSION *by Ellis Jones, M. D., Los Angeles; Frederick G. Linde, M. D., San Francisco; Steele F. Stewart, M. D., Los Angeles.*

IN assuming the responsibility of treating a patient who has sustained a fracture of the osseous system, a surgeon accepts a threefold obligation: First, to sustain the life of the patient. Second, to save the injured member. Third, to restore the function of the injured member in the shortest possible time.

THE SERIES HERE DISCUSSED

The accompanying series of five hundred fractures, treated on the surgical service of St. Vincent's Hospital, Los Angeles, demonstrates the advisability of bringing to the patient the method of treatment most suitable for each particular patient.

Femur	49	Scapula	6
Patella	15	Humerus	47
Both bones, leg	17	Both bones, forearm	28
Tibia	30	Radius	25
Fibula	15	Ulna	17
Potts	27	Colles	26
Astralagas	4	Semilunar	3
Os calcis	14	Scaphoid, hand	6
Scaphoid, foot	2	Thumb	13
Great toe	15	Metacarpal	18
Ankle	16	Phalanges, fingers	12
Phalanges, foot	22	Spine	14
Skull	10	Pelvis	18
Clavicle	28		

BOHLER'S RULES

There is no dogmatic method to which we must adhere in the treatment of fractures, but there are certain fundamental laws which must be observed if a surgeon wishes to obtain best results. Bohler [1] says, "In the treatment of every fracture, the following fundamental rules must be adhered to:

"1. The peripheral fragment must always be placed in the direction where the central one points.

"2. Every fracture must be reduced by means of traction and countertraction.

"3. After the reduction the fragments must be kept continuously in the right position until firm union takes place."

The conscientious surgeon may fulfill the first two of these principles when he aligns the fractured bone ends and applies traction and countertraction. But, unfortunately, it may be said that quite frequently surgeons neglect to keep fractured bone ends continuously in the proper position until nature has had sufficient time in which to produce a sustaining callus. Insufficient fixation and unnecessary examination lead to bowing of the callus and pseudarthrosis.

Plaster of Paris.—It is of historic interest that plaster of paris first came into surgical use in the year 1852. This method of fixation had many evident advantages, and was therefore used by surgeons in the treatment of all fractures, and of all pathologic conditions of joints. The casts applied were of enormous size and, because of their extreme weight, forced the patient to remain in bed, thereby obviating exercise. Because of this injudicious use of a good method of fixation, the pendulum swung the other way, and Lucas-Championière brought out his method of early massage and mobilization. In some instances the surgeon neglected to reduce and align the fractured bone ends before attempting massage. This indiscriminate use of meritorious method unfortunately left its train of poor results. What we surgeons of today should follow is not fixed methods of treatment, but fixed and fundamental principles which will give good functional results in the treatment of fractures.

FRACTURES OF THE FEMORAL NECK

One of the most important fractures which occurs in the body is that of the femur, particularly of the neck of the femur. In this series of five hundred fractures there were forty-nine fractures of the femur; and of these, twenty-two were of the femoral neck. This group of twenty-two may be worthy of analysis.

The object of treatment is to obtain an anatomical replacement of the fragments, together with adequate fixation, maintained until healing has been proved or disproved.

The several methods of traction were discarded early in this series, and Whitman's method was used whenever possible. Nitrous oxid-oxygen anesthesia was given except where contraindicated. Here morphin-scopolamin anesthesia was satisfactorily administered. The thigh was abducted just short of complete abduction together with internal rotation, and a plaster of paris spica was applied which included the entire foot of the injured side and ended just above the knee of the sound side. The patient was then placed on a firm bed and kept there for four months. At this time, healing can be clinically ascertained, augmented by the use of the x-ray.

Granting an accurate reduction in intra-articular fractures, it has been demonstrated that the formation of a callus happens when the blood vessels are permitted to grow uninterruptedly from the spongeosa of one fragment to the spongeosa of the other. Any motion in the hip joint ruptures these delicate blood vessels and permits of resorp-

---

* Read before the General Surgery Section of the California Medical Association at the sixty-first annual session, Pasadena, May 2-5, 1932.